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Three non-hairy species of *Leptogium* from China

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Abstract — *Leptogium javanicum* is reported as new to China, and *L. austroamericanum* and *L. sessile* are reported as new to mainland China. Descriptions and comments for the three species and a key to the non-hairy species known from mainland China are presented.

Key words — taxonomy, *Ascomycota*, *Peltigerales, Collemataceae*, lichenized fungi

Introduction

The lichen genus *Leptogium* (Ach.) Gray comprises about 189 species worldwide (Kirk et al. 2008). Of the 34 species reported for China, 22 have been recorded from the mainland (Wei 1991, Wang et al. 2010, Liu & Guan 2012). Eight out of 17 non-hairy species have been recognized in mainland China: *Leptogium azureum* (Sw. ex Ach.) Mont., *L. cochleatum* (Dicks.) P.M. Jørg. & P. James, *L. cyanescens* (Pers.) Körb., *L. denticulatum* Malme, *L. lichenoides* (L.) Zahlbr., *L. moluccanum* (Pers.) Vain., *L. plicatile* (Ach.) Leight., and *L. subazureum* A. Dube & Makhija (Aptroot et al. 2002, Wei 1991).

In this paper, three additional non-hairy species belonging to the genus are reported. *Leptogium javanicum* is new to China, and *L. austroamericanum* and *L. sessile* are new to mainland China.

Material & methods

The specimens studied are housed in the Herbarium of Nanjing Normal University (NNU), the Herbarium of Cryptogams, Kunming Institute of Botany, Academia Sinica (KUN-L), and Lichen section of Herbarium of Mycology, Academia Sinica (HMAS-L). A dissecting microscope (Motic SMZ-140) and a light microscope (Motic B2) were used for the morphological and anatomical studies. A microtome was routinely used for frozen sections. Photographs were taken with BX51 fluorescence microscope.

New records

Leptogium austroamericanum (Malme) C.W. Dodge, Ann. Mo. Bot. Gdn 20: 419 (1933) Fig. 1A–B

Thallus foliose, 3–8 cm in diam; upper surface grey-blue when dry, with distinct wrinkles, somewhat shiny; lobes orbicular, spreading to erect, 4–10 mm broad, the margin entire to irregularly dentate to isidiate; isidia terete, simple, laminal to marginal, dense, crowded; lower surface similar to upper surface.

Thallus 100–150 μm thick when moist, with single-layered cortex on both sides; upper cortex cells 3–5 μm in diam.; lower cortex cells 4–7 μm in diam.; photobiont *Nostoc* in chains, spherical, 5–6 μm in diam.; hyphae irregularly interwoven.

Apothecia not seen.

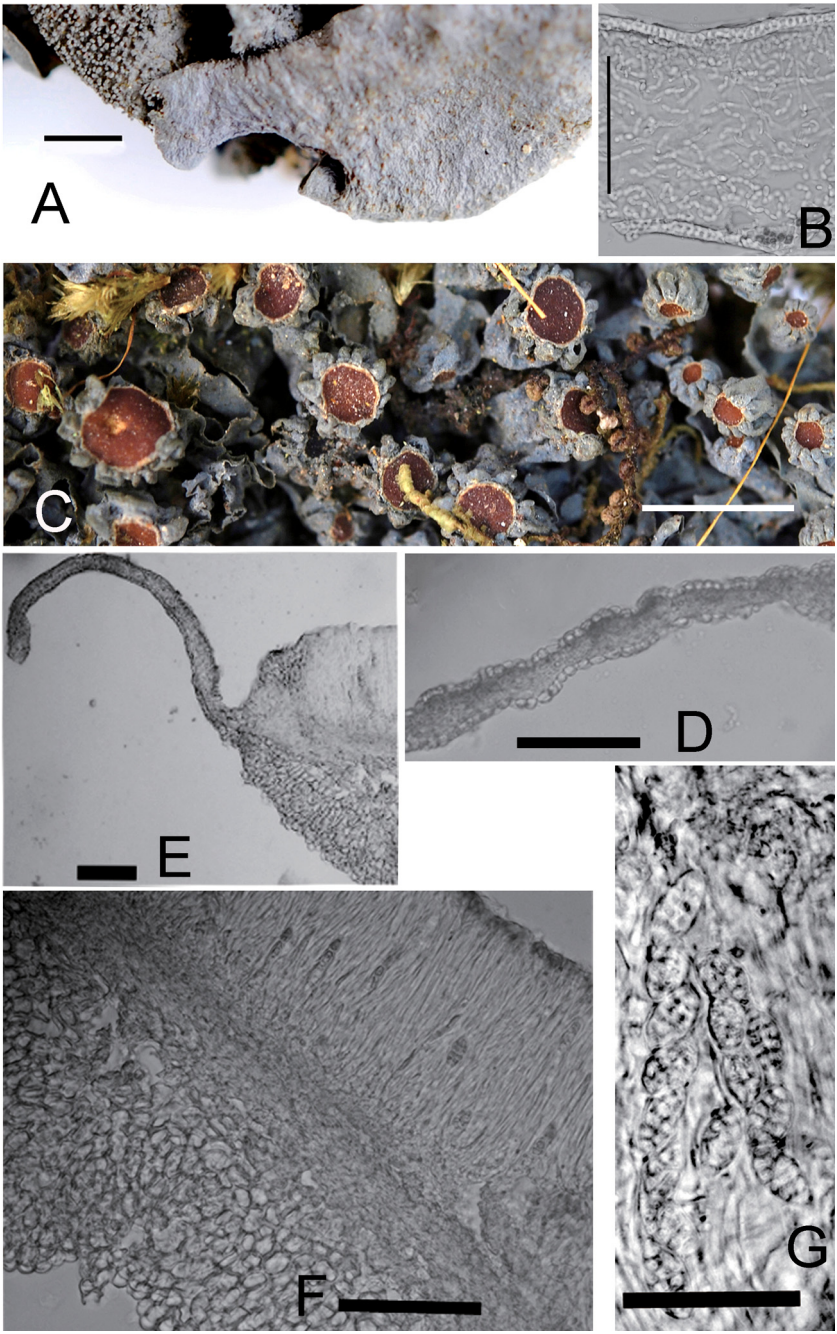
Corticolous or muscicolous.

Specimens examined: **China**. **Zhejiang province**, Mt. Jiulongshan, alt. 570 m, on moss, 28 Apr. 1987, S.F. Chen Z0193 (NNU); **Guangxi province**, Longsheng County, on bark, 21 Aug. 1964, M. Zang 776 (NNU); **Guangdong province**, Nanxiong City, alt. 700 m, on moss, 12 May 1978, A.T. Liu 780087 (NNU); **Yunnan province**, Yingjiang County, alt. 1200 m, on moss, 20 Jun. 1981, X.Y. Wang, X. Xiao & J.J. Su 3121 (HMAS-L: 031791).

Remarks — *Leptogium austroamericanum* is muscicolous or corticolous in montane forests from Southeast and Southwest China at elevations of 570–1200 m. It has been reported from North America, Australia, New Zealand, India, and Taiwan (Sierk 1964, Verdon 1990, Galloway 1999, Awasthi & Akhtar 1979, Aptroot et al. 2002). It is new to mainland China.

Our materials, while similar to those reported in North America in morphology and anatomy, have thinner lobes (100–250(–300) μm in North America). They are also similar to those reported in Australia, but the latter often have squamuliform isidia that were not found in our materials. The materials in New Zealand have isidia granular at first, then become terete and simple, and are coralloid-branched when mature, while in our materials the isidia are always terete and simple. Our materials also differ from those found in India in having larger thalli (1.5–3 cm in India), thicker lobes (60–150 μm in India), and different isidia (terete and simple to branched and squamuliform in India).

Fig. 1. ***Leptogium austroamericanum*** (M. Zang 776, NNU). A. Thallus with isidia. B. Thallus cross-section, showing corticated surfaces. ***Leptogium javanicum*** (L.S. Wang 05-24176, KUN-L). C. Thallus with apothecia. D. Thallus cross-section, showing corticated surfaces. E. Apothecial cross-section. F. Vertical section of the central apothecium. G. Ascus with 8 ascospores. Scale bars: A, C = 1 cm; B, D–F = 100 μm; G = 50 μm.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The species is similar to *L. cyanescens* in the colour of the thallus, numerous simple isidia, and rare apothecia. However, in *L. cyanescens* the thallus is smooth, not wrinkled. Another closely related species, *L. propaguliferum,* produces flattened phyllidia instead of terete isidia.

Leptogium javanicum Mont., Syll. Gen. Sp. Crypt.: 379 (1856) Fig. 1C–G

Thallus 4–7 cm in diam., foliose, outline irregular, crisp; upper surface grey-blue when dry, glabrous, smooth, slightly roughened to striate, without wrinkles, dull; lobes 3–5 mm broad, often suberect, the margin wavy, entire to irregularly lacerate, upturned or downturned; isidia and lobules absent; lower surface similar to the upper surface, but with sparse, brown to blackish, 1.5–3.0 mm long rhizines. Apothecia abundant, dense, laminal to marginal, 1–3 mm in diam., distinctly stalked, at the apex of dome-shaped, vertically furrowed (when dry) lobes; disc plane to concave, red-brown; thalline exciple glabrous, concolorous with the thallus.

Thallus 20–50 μm thick; cortex cells on both sides consisting of a single layer of globular, isodiametrical cells, 5–8 μm in diam.; photobiont *Nostoc* in chains, spherical, 4–6 μm in diam.; hyphae irregularly interwoven.

Apothecia 300–350 μm thick; thalline exciple euparaplectenchymatous, 50–100 μm at margin, consisting of 4–6 layers of subglobose to ellipsoid cells; lower cortex below the apothecium 100–150 μm thick, euparaplectenchymatous, consisting of 7–8 layers of subglobose to ellipsoid, thin-walled cells; proper exciple not seen; hymenium cir. 130 μm high; subhymenium 20–30 μm high; ascus clavate, 100–120 × 15–25 μm, with 8 ascospores; Ascospores submuriform, ellipsoid, 10–20 × 8–12 μm, 3–5 septate transversely, 1 septate longitudinally, obtuse to slightly acute at both ends.

Corticolous.

Specimens examined: **CHINA**. **Yunnan province**, Pu′er City, alt. 1420 m, 18 Jan. 2005, L.S. Wang 05-24176 (KUN-L), 05-24195 (KUN-L); Menghai County, 11 Oct. 1974, X.J. Li 487 (KUN-L 3558).

Remarks — *Leptogium javanicum* is corticolous in montane forests in Yunnan, Southwest China, at an elevation of about 1400 m. It has been reported in India (Awasthi & Akhtar 1979), Nepal, the Galapagos Islands, (Bungartz 2008), and Australia (Verdon 1992). It is new to China.

The Chinese materials are similar to those reported in the Galapagos, but with smaller ascospores (22–30 × 10–15 μm in the Galapagos), less wrinkled upper surface and furrowed apothecial stalks. It is also similar to those reported in Australia (Verdon 1992) in having furrowed, hollow stalks that attach to the upper apothecial margins, but our materials have smaller ascospores (25–35

× 13–15 μm in Australia) and less-wrinkled and thinner thalli (60–120 μm in Australia).

Leptogium javanicum can be readily recognized by its apothecia at the apex of the dome-shaped lobes and its suberect lobes. It also somewhat resembles *L. verrucosum* with respect to the thallus colour and poorly developed proper exciple. However, *L. verrucosum* has larger ascospores (15–32 × 6–12 μm) and a warty thallus owing to the presence of numerous pycnidia.

Leptogium sessile Vain., Ann. Acad. Sci. Fenn., Ser. A 6(7): 108 (1915) Fig. 2

Thallus 2–6 cm in diam., foliose; upper surface grey-blue when dry, with distinct wrinkles, shiny; lobes orbicular, 5–10 mm broad, the margin entire and downturned; isidia absent; lower surface similar to upper surface. Apothecia common, ± dense, laminal to submarginal, sessile, 1–2 mm in diam.; disc plane to concave, red-brown; thalline exciple wrinkled, concolorous with the thallus.

Thallus 170–450 μm thick; cortex cells on both sides consisting of a single layer of globular, isodiametrical cells, 4–5 μm in diam.; photobiont *Nostoc* in chains, spherical, 4–6 μm in diam.; hyphae irregularly interwoven.

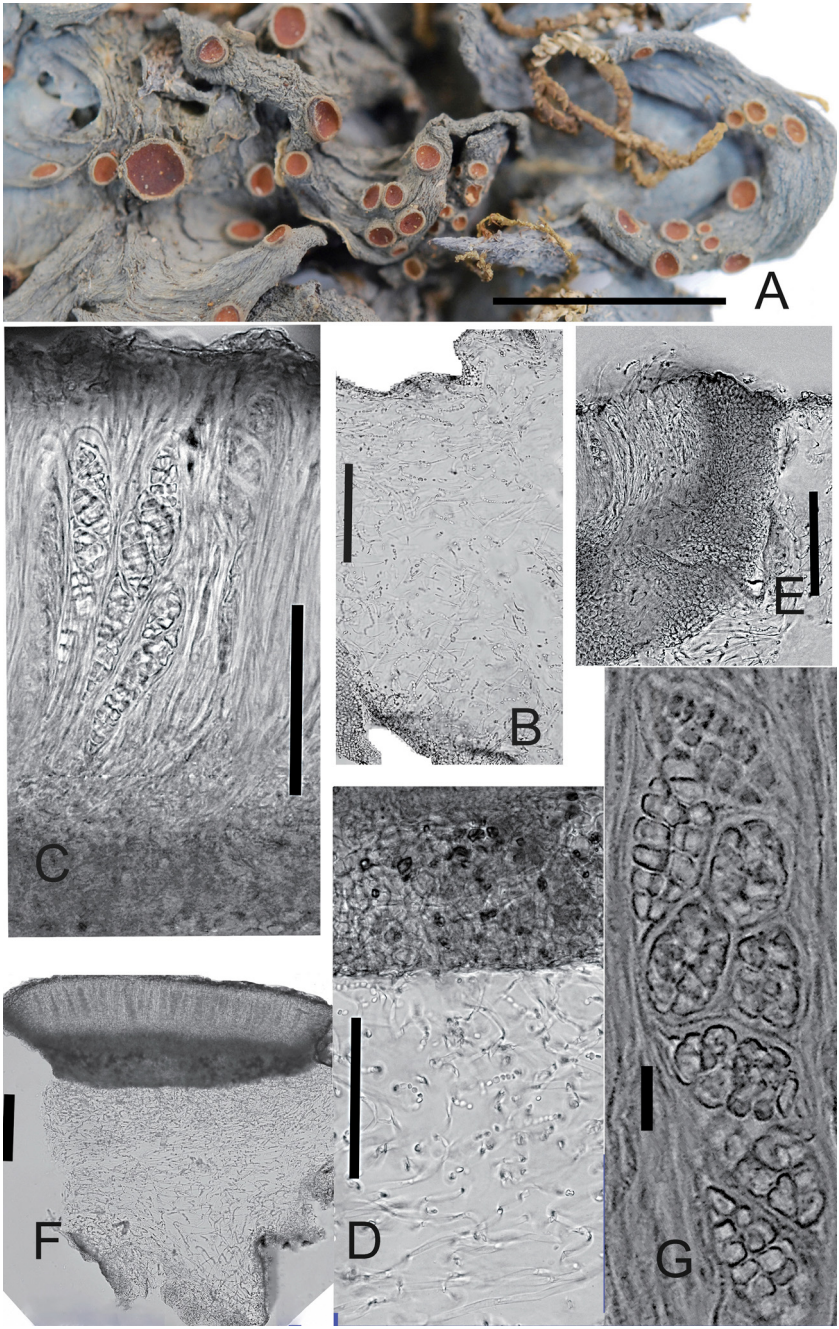
Apothecia 550–700 μm thick; Thalline exciple 4–5 μm thick at margin, consisting of a single-layered, thin-walled, subglobose cells, 4–5 μm in diam., and an algal layer with loosely to somewhat densely interwoven hyphae; proper exciple euparaplectenchymatous, 70–120 μm thick; hymenium 175–225 μm high; subhymenium 50–70 μm high; ascus clavate, 100–125 × 10–15 μm; Ascospores 8 per ascus, submuriform to muriform, ellipsoidal, 25–35 × 8–13 μm, 3–7 septate transversely, 1–2 septate longitudinally.

Corticolous.

Specimens examined: **CHINA**. **Anhui province**, Mt. Huangshan, on bark, 7 Sept. 1974, J.N. Wu & T. Xiang, 740078 (NNU); **Yunnan province**, Lvchun County, on moss, 15 May. 1975, X.J. Li, 74-1724 (KUN-L); Ruili City, on bark, 30 Nov. 1980, Y.M. Jiang, 587-2 (HMAS-L 031787); Weixi County, alt. 2100 m, on bark, 13 July. 1981, X.Y. Wang, X. Xiao & J.J. Su, 3699 (HMAS-L 031771).

Remarks — *Leptogium sessile* is mainly corticolous in montane forests of Southwest and Southeast China. This species has been reported from North America and Taiwan (Sierk 1964, Aptroot et al. 2002). It is new to mainland China.

Our materials are similar to those reported in North America, but with somewhat thinner lobes (300–500 μm thick in North America), and narrower ascospores (23–35 × 12–16 μm in North America). Although the North American materials have ascospores with 0–2 longitudinal septa (Sierk 1964), no such septa were found in our materials from China.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Leptogium sessile resembles *L. corticola* in having a distinctly wrinkled upper surface, sessile apothecia, and an euparaplectenchymatous proper exciple. However, *L. sessile* can be separated by its larger ascospores (16–26 × 10–13 μm in *L. corticola*) and downturned lobe margins.

Key to the non-hairy *Leptogium* species in mainland China

1 Thallus dark brownish black, often with a reddish tinge. . . . . *L. plicatile*
Thallus grey or blue 2

2 Thallus isidiate. 3
Thallus not isidiate 5

3 Isidia cylindrical 4
Isidia squamuliform . . . . . *L. denticulatum*

4 Thallus pale to dark grayish blue to olive green; isidia granular-furfuraceous, cylindrical to clavate to lobulate, often branched. . . . . *L. cyanescens*
Thallus grey-blue; isidia terete, simple. . . . . *L. austroamericanum*

5 Thallus distinctly wrinkled 6
Thallus smooth to slightly roughened 8

6 Thallus with erect to semi-erect lobes, sometimes forming a dense cushion . . . . . *L. lichenoides*
Thallus with numerous, overlapping lobes forms elegant, spreading patches 7

7 Lobes distinctly thicker (170–450 μm) . . . . . *L. sessile*
Lobes thinner (100–150 μm). . . . . *L. cochleatum*

8 Apothecia distinctly stalked, at the apex of dome-shaped, vertically furrowed (when dry) lobes . . . . . *L. javanicum*
Apothecia sessile or shortly stipitate 9

9 Spores larger (25–40 × 10–15 μm) . . . . . *L. subazureum*
Spores smaller (16–25 × 6–13 μm). 10

10 Thallus grey to lead grey, lobes 40–60 μm thick. . . . . *L. moluccanum*
Thallus blue to blue-grey, lobes 50–100 μm thick . . . . . *L. azureum*

Fig. 2. ***Leptogium sessile*** (HMAS-L: 031771). A. Thallus with apothecia. B. Thallus cross-section, showing corticated surfaces. C. Hymenium with asci. D. Vertical section of the central apothecium showing euparaplectenchymatous proper exciple with medulla below. E. Thalline margin, showing euparaplectenchymatous proper exciple and thalline exciple. F. Apothecial cross-section. G. Ascus with 8 ascospores. Scale bars: A = 1 cm; B–F = 100 μm; G = 10 μm.

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